THE SHERWIN-WILLIAMS COMPANY
Environmental, Health & Regulatory Services
101 Prospect Avenue NW
Cleveland, Ohio 44115-1075
Facsimile: (216) 566-2730

June 29, 2009

Mr. Ray Klimcsak
U.S. Environmental Protection Agency – Region 2
290 Broadway 19th Floor
New York, New York 10007-1866

RE: Response to EPA Letter dated May 18, 2009
The Sherwin-Williams Company (February 18, 2009) Response to EPA Letter dated January 14, 2009 EPA's Comments on the *"Revised" Route 561 Dump Site Ground Water Contour Maps* (dated August 29, 2008)

The Sherwin-Williams Company Sites – RI/FS Activities
Gibbsboro, New Jersey
Administrative Order Index No. II CERCLA-02-99-2035

Dear Mr. Klimcsak:

The Sherwin-Williams Company (Sherwin-Williams) has prepared this reply in response to the U.S. Environmental Protection Agency (EPA) letter dated May 18, 2009 regarding EPA's review of Sherwin-Williams' *Route 561 Dump Site Groundwater Investigation – Technical Memo* dated April 29, 2009.

We are providing a point-by-point response to the detailed comments contained within the May 18, 2009 letter, and in order to ease your review, have included the text from that letter which is depicted in *italics*. Sherwin-Williams' response immediately follows each EPA comment in **bold**. A copy of the May 18, 2009 letter is included as an attachment.

Comments

1. *EPA requests to be present for the final selection of the 3 proposed pore water sample locations.*

Sherwin-Williams will coordinate the final selection of the 3 proposed pore water sample locations with EPA. Sherwin-Williams proposes that a site walk be scheduled so that EPA and/or their oversight contractor can participate in the selection of these sample locations.

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2. *EPA requests that additional clarification be provided in regards to the proposed collection of purge water during monitoring well installation operations, as currently described in Appendix A, Page A-12 of the Route 561 Dump Site Technical Memo. The text currently states that purge water will be collected in 55-gallon drums. This is contrary to previous discussions with Sherwin-Williams when discussing the fate of purge water during monitoring well re-development activities at the Former Manufacturing Plant (FMP). Please ensure that proper protocols are utilized and accurately presented in the Technical Memo.*

Sherwin-Williams is proposing that the development water will be discharged to the ground adjacent to the monitoring well. Discharge of the development water to the ground surface where the water is considered to be contaminated is permissible by the NJDEP August 2005 "*Field Sampling Procedures Manual*" provided the following conditions are met: 1) the water is not permitted to migrate off-site; 2) there is no potential for contaminating a previously uncontaminated aquifer; and 3) the discharge will not cause an increase to ground surface soil contamination. As provided in the June 2007 *"NJPDES Discharges to Ground Water Technical Manual for the Site Remediation Program"*, discharges to groundwater at remediation sites associated with the installation, development, and sampling of monitoring wells do not require a written pre-approval from the NJDEP or public notification.

3. *It is stated in Appendix A (Page A-13) that monitoring well samples will be collected for: Contract Laboratory Program (CLP) analyses for TAL metals, cyanide, total organic carbon (TOC), total dissolved solids (TDS) and total suspended solids (TSS). EPA is requesting that all wells be sampled and analyzed for full-scan parameters.*

Sherwin-Williams will analyze all groundwater samples collected from the monitoring wells for Target Compound List (TCL) Volatile Organic Compounds (VOCs), TCL Semivolatile Organic Compounds (SVOCs); Target Analyte List (TAL) Metals plus cyanide, TCL Polychlorinated Biphenyls (PCBs) and Pesticides as well as Total Organic Carbon (TOC), Total Dissolved Solids (TDS) and Total Suspended Solids (TSS).

4. *An "un-signed" copy of EPA's August 14, 2007 Comment Letter (on Response to EPA Letter dated August 7, 2006 – Appendix A [Dump Site Groundwater Investigation – November 30, 2006]) was submitted as part of the Route 561 Dump Site Groundwater Technical Memo. Please submit the official signed copy that was mailed to the Sherwin-Williams Company on August 14, 2007.*

Sherwin-Williams has attached the official signed copy of the above-referenced letter that was mailed to Sherwin-Williams on August 14, 2007. The date stamp on this letter is August 13, 2007. This signed copy should replace the unsigned copy of the same letter that was included with the *Response to EPA Comment Letter Dated August 14, 2007 regarding review of November 30, 2006 Response to EPA Letter Dated August 7, 2006 - Appendix A (Dump Site Groundwater Investigation)* that was dated April 29, 2009.

Please note that as part of this submission, Sherwin-Williams has included revised pages A-12 and A-13 of Appendix A that incorporates all the comments contained within this letter. Please replace the existing pages with these revised pages in the Appendix A document that was included with the *Response to EPA Comment Letter Dated August 14, 2007 regarding review of November 30, 2006 Response to EPA Letter Dated August 7, 2006 - Appendix A (Dump Site Groundwater Investigation)* that was dated April 29, 2009.

Should you have any questions or comments regarding this response, please do not hesitate to contact me at (216) 566-1794 or via e-mail at mlcapichioni@sherwin.com.

Sincerely,

Mary Lou Capichioni

Mary Lou Capichioni
Director Remediation Services

Attachment
cc: J. Josephson, USEPA
C. Howard, USEPA
M. Pensak, USEPA
W. Sy, USEPA
J. Doyon, NJDEP (4 copies)
H. Martin, ELM
S. Jones, Weston

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 2
290 BROADWAY
NEW YORK, NY 10007-1866

AUG 13 2007

Ms. Mary Lou Capichioni
Director
Remediation Services
Corporate Environmental Services
The Sherwin-Williams Company
101 Prospect Avenue, N.W.
Cleveland, OH 44115-1075

Re: *Sherwin-Williams Gibbsboro Sites*
Response to EPA Letter Dated August 7, 2006
Sherwin-Williams Gibbsboro Sites, Route 561 Dump Site - Appendix A (November 30, 2006)

Dear Ms. Capichioni:

The U.S. Environmental Protection Agency (EPA) has completed its review of the November 30, 2006 *Response to EPA Letter Dated August 7, 2006 - Appendix A (Dump Site Groundwater Investigation)* submitted by the Sherwin-Williams Company (SWC) pursuant to Administrative Order Index No. II CERCLA-02-99-2035 for Remedial Investigation/Feasibility Study activities and offers the following comments.

1. SWC response letter, page 6 – SWC states that, based on the information presented in Appendix A, their previous conceptual model is valid and "that the well locations originally proposed are appropriate for the next phase of the groundwater investigation, and is requesting EPA concurrence with these locations." Based upon the following discussion, EPA does not concur with this statement and still contends that flow directions and velocities at the Route 561 Dump Site are not demonstrated.

2. Appendix A, Page A-3 – The text states that the groundwater flow is "reflective of the topography" and that "Surface water elevation data....were used as control elevation points to aid in the groundwater contour design in the vicinity of creeks and water bodies." Examination of Figures A-1, A-2, and A-3 prove that this is incorrect. Much of the Route 561 Dump Site area depicts groundwater contours which are topographically higher than surface elevations. This error has caused SWC to make incorrect assessments of groundwater flow directions and flow velocities. Instead of a tabular flow pattern that is directed to the southwest, the flow patterns are going to be quite variable and highly affected by surface topography. This error must be corrected before additional well locations can be selected.

3. Appendix A, page A-4 – The horizontal hydraulic gradients in the text are incorrect. Instead, the gradients are going to be quite variable, depending upon location, and proximity to the surface water.

4. Appendix A, page A-5 – The lower bound on hydraulic conductivity stated in the text is likely incorrect. Examination of the curve match indicates that there was no sand pack porosity supplied for this analysis. EPA recommends a re-examination of this analysis and re-calculation of the averages.

5. Appendix A, page A-5 – The upper bound on hydraulic conductivity results from using the Hvorslev method of analyzing slug test results. This method has been mathematically proven to be valid only in zero-penetration conditions (i.e., the screen does not penetrate the thickness of the aquifer.) Please do not use this method of analysis for these data. Please recalculate the averages with an acceptable method.

6. Appendix A, page A-5 and A-6 – The numbers quoted for seepage velocity are incorrect. See comments above for explanation.

7. Table 4 – Please remove the Hvorslev results and recalculate the averages. (Also, fix Slug-in2 for DMMW0001.)

8. Figures 1A, 2A, and 3A – Please re-contour these figures and use surface water elevation data "as control elevation points to aid in the groundwater contour design in the vicinity of creeks and water bodies;" (i.e., check to make sure your groundwater elevation contours are not above the surface topography.)

If you have any questions on this matter, you may contact Mr. Ray Klimcsak, of my staff, at (212) 637-3916, or if you have any legal concerns, Mr. Carl Howard, Esq., at (212) 637-3216.

Sincerely yours,

Carole Petersen, Chief
New Jersey Remediation Branch

cc: Sally Jones, Weston
Hank Martin, ELM
John Doyon, NJDEP
Lynn Arabia, TetraTech

APPENDIX A
GROUNDWATER INVESTIGATION

Introduction

Three monitoring wells were installed, developed and sampled during the Remedial Investigation (RI) activities conducted at the Sherwin-Williams Route 561 Dump Site during Summer 2005. Slug tests were also performed at each of the wells in order to develop an estimate of hydraulic conductivity and seepage velocity. The following is a compilation and description of the activities performed.

Drilling and Monitoring Well Installation

Between July 22 and July 26, 2005 three monitoring wells (DMMW0001, DMMW0002 and DMMW0003) were installed at the Dump Site during the Gibbsboro RI activities. The Dump Site is located between Clement Lake and Lakeview Drive (Route 561). The drilling and monitoring well installations were conducted by East Coast Drilling, Inc. (ECDI) of Moorestown, New Jersey. ECDI is a New Jersey licensed driller (New Jersey License No. M1224). All drilling and monitoring well work was performed under supervision of trained and experienced Weston Solutions, Inc. (Weston®) personnel.

All borings were advanced by ECDI with a rubber-tracked model 6610DT Geoprobe® rig capable of hollow-stem auger (HSA) borings. Direct-push technology was used for logging of soil samples from each well location. Drilling was limited to the upper 15 feet below ground surface (bgs). A 5-foot MacroCore® sampler and disposable acetate sleeves were used for collection of all soil samples. All soil samples were inspected and logged by a qualified field geologist and field screened using a photoionization detector (PID). Subsequent to the field activities a soil boring log was created for each boring describing the soil types encountered, visual observations such as staining, and PID readings. No soil samples were collected for laboratory analyses.

Monitoring wells were installed by over-drilling each soil boring location using 8-inch outside diameter (4.25-inch inside diameter) hollow-stem augers. The monitoring wells were constructed of 2-inch-diameter, schedule-40 polyvinyl chloride (PVC) well screens and riser pipes. The well screens were 10 feet in length and had 0.010-inch (10-slot) slot sizes. The well filter pack was constructed with Morie sand #1, and granulated bentonite was used to fill the annular seal above the sand filter pack. The filter packs were placed in the well borehole from approximately 1.0 foot below, or at the bottom of the well screens, up to approximately 1.0 to 2.0 feet above the screen. A finer Morie sand #00 was used as a choke layer between the filter pack and the bentonite seal. All wells were finished above grade using 6-inch diameter protective steel stick-up outer casings. Sloping concrete pads measuring approximately 2 feet by 2 feet and 4-6 inches thick were placed around the protective outer casings to seal and secure the wells above ground. All wells were marked with their respective identifications on steel tags held by steel collars around the well outer casings.

A summary of monitoring well construction details is provided in Table 1 and the complete Soil Boring and Monitoring Well Construction Logs are provided in Attachment 1. Soils encountered in the Dump Site predominantly consist of fine to coarse sand with varying amounts of silt and gravel. Detailed lithologic descriptions are presented in the above-referenced soil boring logs provided in Attachment 1.

Copies of the New Jersey Department of Environmental Protection (NJDEP) Monitoring Well Permit (DWR-133M), Monitoring Well Records, and Monitoring Well Certifications (Form A) are provided in Attachment 2.

All attachments, tables and figures included with this submission are included on the accompanying CD.

Monitoring Well Development

The monitoring wells were developed following installation by using a surge block and small submersible pumps (Whale and/or Typhoon pumps). The pump was initially placed at the bottom of the well screen and manually surged up and down at periodic intervals. A portable turbidity meter (LaMotte Model 2020) was used to monitor water turbidity during well development. The turbidity meter was calibrated in the field prior to well development using turbidity standards of 1 and 1,000 nephelometric turbidity units (NTU). Water was collected directly from the dedicated polyethylene pump discharge tubing at 5-minute intervals for turbidity monitoring. The development water was containerized in 55-gallon drums, labeled, and stored on site for future disposal.

The monitoring wells were developed between 45 minutes to a maximum of 4 hours until the development water became relatively silt-free and clear based on turbidity readings. Final turbidity readings at wells DMMW0001 and DMW0003 were below 10 NTU. Well DMMW0002 was developed on two occasions for a total time of over 4 hours. The final turbidity at DMMW0002 was 55 NTU. Well development data are summarized in Table 2 included on the accompanying CD.

Monitoring Well Survey

The monitoring wells were surveyed by T&M Associates, of Moorestown, New Jersey. T&M Associates is a New Jersey-licensed surveyor (N.J.P.L.S. No. 32106). Well survey data included all horizontal locations, ground surface elevations, top of inner PVC casing (TIC) elevations, and top of outer protective casing (TOC) elevations. The elevations (NAVD 88) were reported to the nearest hundredth of a foot based on first order survey benchmarks. Location coordinates were reported using both the Global Positioning System (GPS) geographic coordinates to the nearest 0.01 second and the New Jersey State Plane Coordinate System (NAD 83) to the nearest 0.01 foot. Monitoring Well Certification Form Bs are included in Attachment 3 included on the accompanying CD.

In addition to monitoring wells, Weston sited two elevation control points (designated as Control Monuments [CM]) at strategic locations within the Dump Site to aid in the measurement of surface water elevations along White Sand Branch, which originates below Clement Lake and flows through the Dump Site. The elevation control points used for the Dump Site were located on the Route 561 bridge/culvert (designated CM-12) and the Clement Lake outlet structure (designated CM-13).

The control monuments also were surveyed by T&M Associates to establish horizontal location and vertical elevation data. The elevations (NAVD 88) were reported to the nearest hundredth of a foot based on first order survey benchmarks. Monument survey location coordinates were reported in both the GPS geographic coordinates to the nearest 0.01 second and the New Jersey State Plane Coordinate System (NAD 83) to the nearest 0.01 foot.

Groundwater and Surface Water Elevation Measurements

Between October 2005 and March 2006, Weston conducted groundwater elevation monitoring events using the Dump Site wells. After the elevation control points were designated and surveyed, Weston also conducted an additional round on September 12, 2006 to collect synoptic groundwater and surface water elevation measurements.

A Solinst® oil-water interface probe was used to measure depth to water (DTW) in the monitoring wells. Depth to water was measured in relation to the wells' TIC. Surface water elevations were obtained in September 2006 at four locations (DS01, DS02, DS03, DS04) using a level (David White Model 8824) and survey rod. The surface water elevation was calculated to the nearest 0.01 foot in relation to the elevation of the elevation control point.

Groundwater elevations were calculated by subtracting the measured DTW from the TIC elevation. The groundwater and surface water elevation data were used to construct groundwater contour maps for the Dump Site. A summary of the measured depth to water, groundwater elevation, and surface water elevation data for the Dump Site is given in Table 3 included on the accompanying CD.

Based on the groundwater measurements, the groundwater within the Dump Site is unconfined. At DMMW0001, located in an upland portion of the Dump Site, the DTW ranged from approximately 5.5 to 7.4 feet bgs. Between October 2005 and September 2006, a seasonal groundwater fluctuation of approximately 1.9 feet was measured at DMMW0001. DMMW0002 and DMMW0003 are located in topographically lower portions of the Dump Site. The DTW at DMMW0002 ranged from approximately 0.2 to 0.6 feet bgs. At DMMW0003 the DTW ranged from approximately 0.2 to 0.6 feet above ground surface. Seasonally, groundwater fluctuated less than 0.5 feet at DMMW0002 and DMMW0003 between October 2005 and September 2006.

Groundwater Contour Maps

The groundwater contours were designed using hand contouring techniques. Surface water elevation data (September 2006 only) were used as control elevation points to aid in the groundwater contour design in the vicinity of creeks and water bodies. Groundwater contour maps for three select events of groundwater monitoring are presented in Figures A-1 through A-3. The November 2005, January 2006, and September 2006 events were selected because they are representative of expected seasonal fluctuations in shallow groundwater.

A springtime event, March 2006, was not contoured because the depth to water measurements at DMMW0001 and DMMW0002 were not consistent with the other six rounds of groundwater measurements (Table 3). Based on Sherwin-Williams review of the data, it appears that the depth to water measurements at DMMW0001 and DMMW0002 were inadvertently transposed during the March 2006 field event.

Groundwater contour maps from November 2005, January 2006, and September 2006 were used to assess groundwater flow directions and calculate average horizontal hydraulic gradients across the Dump Site. Based on the groundwater contour maps the inferred groundwater flow direction is generally from the perimeter of the Dump Site, towards the axis of the stream channel and perpendicular to the topographic contours.

Hydraulic Conductivity Tests

Slug tests were performed at all three Dump Site wells (DMMW0001, DMMW0002 and DMMW0003) on September 8, 2005 to obtain representative average horizontal hydraulic conductivity values. At each monitoring well two rising head and two falling head slug tests were performed to ensure reproducibility.

An In-Situ® miniTROLL® 9000 data logger with a 15 pounds per square inch (PSI) pressure/level and temperature sensor was used to collect continuous water displacement measurements from the monitoring wells during the slug tests. A Solinst® electronic water level meter was used to measure initial depth to groundwater prior to slug testing and determine how far into the water column the slug needed to be lowered. The slug consisted of a 3-foot-long PVC pipe (1-inch ID, 1.13-inch OD) filled with cement and sealed on both ends with PVC caps. The volume of the slug was calculated to be 53.33 cubic inches (in^3).

Groundwater displacements were recorded continuously at one-second intervals, first with the slug placed in (i.e., falling head test) and then with the slug taken out (i.e., rising head test) of the well. This procedure was repeated once (slug-in1, slug-out1, slug-in2 and slug-out2) for each well for verification of data consistency. The slug test data were recorded in real time with the miniTROLL-interfaced palm computer data logger.

Once the field data were collected, aquifer test results were interpreted at Weston's Edison, New Jersey office using software (Aqtesolv® – v-4.50.002) that provided plots for visual curve-matching of aquifer straight-line solutions to time-displacement data measured during the field tests using various analytical methods that are discussed in the following section.

Site-Specific Aquifer Test Assumptions and Results

Based on Weston's previous experience at the site, the aquifer is assumed to be unconfined and isotropic near the surface with a saturation thickness of approximately 30 feet (lithological transition of upper saturated sands, gravels and silt layers with underlying very fine, compacted, micaceous sands) beneath the site.

Of the three wells installed in the Dump Site, one well (DMMW0001) has a partially submerged screen so a gravel pack correction using a porosity value of 30% was applied during the data analysis to account for drainage from the gravel pack. As applicable, the straight line fit to the second linear segment of the solution was selected for the hydraulic conductivity estimate.

The remaining two wells (DMMW0002 and DMMW0003) have screens fully submerged in the aquifer so a gravel pack correction for partially submerged screens was not required for DMMW0002 and DMMW0003.

Slug test data were evaluated by five analytical methods including:

- Bouwer and Rice (1976),
- Hvorslev (1957);
- Hyder et al. (also known as KGS Model) (1994);
- Dagan (1978); and
- Springer-Gelhar (1991).

The basic assumptions used for all of these methods include:

- Aquifer has infinite areal extent
- Aquifer is homogeneous and of uniform thickness
- Test well is fully or partially penetrating
- Aquifer is unconfined
- Flow to well is quasi-steady-state (storage is negligible)
- Volume of slug, V, is injected into or discharged from the well instantaneously
- Flow is unsteady (KGS method only)
- Water is released instantaneously from storage with decline of hydraulic head (KGS method only).

For each method, the Aqtesolv® definitions and assumptions are provided in Attachment 4 included on the accompanying CD.

Aqtesolv® 4.50.002 Professional was used for the solution calculations and curve fitting. All graphical solutions are provided as Attachment 5 included on the accompanying CD. The results of all the slug test methods are provided as Table 4 included on the accompanying CD. Arithmetic means of each solution method are provided for each well. The geometric means (using the arithmetic means from each well) are provided for each method used.

Because the Bouwer and Rice (1976) method is generally accepted given the site conditions (i.e., unconfined aquifer with partially penetrating wells), these data were used as a benchmark for the comparison of other slug test solution methods. The Bouwer and Rice (1976) results indicate an estimated hydraulic conductivity range of approximately 0.8 – 5.2 ft/day for the shallow groundwater.

The Hvorslev (1951) and Dagan (1978) methods yielded results greater than or equal to the results calculated using the Bouwer and Rice (1976) estimates. The Hvorslev (1951) estimated range of approximately 1.2 – 8.5 ft/day. The Dagan (1978) estimated range is approximately 0.8 – 6.9 ft.day.

The KGS (1994) and Springer-Gelhar (1991) methods yielded consistently lower results than the Bouwer and Rice (1976) estimates. The combined estimated range of the KGS (1994) and the Springer-Gelhar (1991) methods is 0.7 – 1.8 ft/day.

A linear correlation plot of the slug test data is provided (Attachment 5, Figure 1) and for each well an assessment of the precision of each method was made based on the relative standard deviation (Attachment 5, Table 1). The median was used for this evaluation because it is less affected by outlier data than the mean. The precision was very low for all methods at DMW0001 and DMW0003. Precision was moderate to high for all methods used to estimate hydraulic conductivity at DMW0002. The highest precision was experienced for the Bouwer and Rice (1976) method at DMW0002.

The statistical analysis of precision has generally shown the Bouwer and Rice (1976) method yields a higher level of precision at wells DMMW002 and DMMW003 than the other methods used. The lower precision calculated at well DMMW001 using the Bouwer and Rice (1976) estimates relative to the other method estimates may be caused by the inclusion of falling head solutions where the entire screen interval is not saturated.

Recommendations for Hydraulic Conductivity

Sherwin-Williams has evaluated various slug test methodologies and based upon that evaluation recommends that the Bouwer and Rice (1976) Method be used for any future site-specific calculations (e.g., seepage velocity) which require an estimated hydraulic conductivity parameter. Depending on the use of calculation, either well-specific arithmetic mean values or site-specific geometric mean values may be applied. As previously discussed, these values are summarized in Table 4. The Bouwer and Rice (1976) solution is selected because: 1) this most commonly used method is generally accepted by EPA for unconfined aquifers; 2) the differences between all solutions evaluated were less than an order of magnitude; and 3) the Bouwer and Rice (1976) results have a high precision relative to the other methods.

Site-Specific Groundwater Horizontal Hydraulic Gradient

Based on the topography different gradients may be calculated depending upon the location of the well and its relative location to the other wells (or measuring points) within the Dump Site.

For the purpose of estimating a site specific value, horizontal hydraulic gradients were calculated using various wells and measuring points located throughout the site. The intent is to calculate a gradient from the highest to lowest elevation in a direction parallel to the axis of stream flow and perpendicular to the topography. The elevation data from the September 2006 gaging event was used for these calculations.

In order to calculate a horizontal hydraulic gradient parallel to the axis of the stream, the surface water elevation data from measuring points DS-02 (located upstream adjacent to Clement Lake) and DS-04 (located downstream at the culvert exiting the Dump Site) were used. The horizontal hydraulic gradient calculated using the streamflow measuring points was calculated to be 0.009 ft/ft for the September 2006 event.

In addition to this, a separate gradient in a downgradient direction that is perpendicular to the topography was also calculated using DMMW0001 (located upgradient adjacent to the Wawa strip mall) and DS-04 (located downgradient at the culvert exiting the Dump Site). The horizontal hydraulic gradient estimated using data from DMMW0001 and DS-04 was calculated to be 0.018 ft/ft for the September 2006 event.

Site-Specific Groundwater Seepage Velocity

In order to calculate the range of seepage velocities, the hydraulic conductivity values derived from the Bouwer and Rice Method discussed above were used. The data from the September 12, 2006, gaging event were chosen as representative of site conditions and were subsequently used in the seepage velocity calculations. The seepage velocity is calculated by:

$$v = \frac{K(dh)}{n(dl)}$$

where,

v = seepage velocity
K = hydraulic conductivity
dh/dl = horizontal hydraulic gradient
n = porosity = 0.3

A seepage velocity was calculated for both of the horizontal hydraulic gradient regimes discussed in the previous section using the respective hydraulic conductivity calculated by the Bouwer and Rice (1976) method for each well. A separate calculation was also performed using the site geometric mean calculated using Bouwer and Rice (1976).

When calculating the seepage velocity using the horizontal gradients determined from DS-02 to DS-04 (along the axis of the stream), the seepage velocity ranged from 0.02 to 0.04 ft/day. When the site geometric mean K value (1.694 ft/day) was used, the seepage velocity was calculated as 0.05 ft/day.

When calculating the seepage velocity using the horizontal gradients determined from DMMW0001 to DS-04, the seepage velocity ranged from 0.08 to 0.32 ft/day. The seepage velocity of 0.32 ft/day was calculated using the hydraulic conductivity of 5.222 ft/day from DMMW0001. Upon inspection of the boring logs for this well, it is likely that this high K (relative to the other wells on-site) may be attributed to the less dense and looser soils in the vicinity of this well.

When the site geometric mean K value (1.694 ft/day) was used, the seepage velocity was calculated as 0.10 ft/day.

A summary of the seepage velocity calculations using the hydraulic conductivity derived from the Bouwer and Rice (1976) solutions is presented in Table 5 included on the accompanying CD.

Given the difference in ground water seepage velocities between the side slope of the Dump Site compared to the axis of the stream, ground water would be expected to be seeping from the side slopes since it cannot exit the valley as fast as ground water flows into the valley. This condition is present to some degree as illustrated by the artesian conditions documented in well DMMW0003 where the DTW ranged from approximately 0.2 to 0.6 feet above ground surface. In addition, the axis of the stream is a marshy area where ground water is present at the surface continually supplying water to White Sands Branch. However, due to the likely variability in porosity throughout the shallow water bearing zone (compared to the value used in the seepage velocity calculations) and the higher conductivity value calculated in well DMMW0001 the mathematical representations suggest much more extreme conditions should be present at the site.

Groundwater Sampling

The Dump Site wells were sampled approximately one month apart during two separate events in August and September 2005.

During the sampling events, all monitoring wells were purged and sampled using a micro-purge bladder pump equipped with new, dedicated Teflon® discharge tubing. All sampling equipment was decontaminated prior to initial use, between each sampling location, and after completion of the groundwater sampling event. Severn Trent Laboratories (STL) conducted the sampling events and collected all field parameters under supervision of Weston. STL is an NJDEP certified laboratory (certification number 12028).

The wells were purged and sampled following the EPA low-flow groundwater sampling protocols and consistent with NJDEP protocols. While the monitoring wells were being purged, the water quality parameters of temperature, pH, Eh, dissolved oxygen and specific conductivity were monitored using the Hach Sensor 1 multi-parameter water quality meter every three to five minutes until stabilization was achieved. Another parameter, turbidity, was monitored separately during purging using a LaMotte Model 2020 turbidity meter. Depth to water was monitored using a Solinst® electronic water level meter. A Solinst® interface probe was also used for groundwater-level monitoring to check for the presence of non-aqueous phase liquids (NAPLs) in groundwater. All purging parameter observations were recorded noting the presence of discernible odors and visible sheens. A PID (MultiRAE Plus) was used to measure the presence of volatile organic compounds (VOCs) in the well casings prior to any well monitoring.

Following collection in the field, groundwater samples were immediately transferred to a cooler with ice. A chain-of-custody was created at the end of each sampling event and delivered with the samples to STL in Edison, NJ. The analytical requirements for groundwater samples included Contract Laboratory Program (CLP) analyses (VOC+15, BNA+25, PCB, PCP, metals, cyanide) and a number of monitoring of natural attenuation (MNA) parameters (CO^2, TOC, TDS, TSS, Fe^{2+}, sulfide, sulfate, nitrate, nitrite, alkalinity, methane, ethane, ethene and chloride). A 4-week turnaround time was requested for the analyses.

In addition to investigative samples, quality assurance/quality control (QA/QC) samples were collected in accordance with Weston's Quality Assurance Project Plan (QAPP). Blind field duplicate and matrix spike/matrix spike duplicate (MS/MSD) samples were collected at a rate of one per 20 samples per analytical parameter. Field blanks were collected minimally once per event and analyzed for the same parameters as the field samples. Trip blanks (laboratory deionized water) were analyzed for VOCs once per shipment.

The groundwater sampling analytical results were previously submitted under separate cover in the document entitled *Evaluation of Strategic Sampling Results, Route 561 Dump Site* (May 23, 2006).

Proposed Monitor Well Installation

Presently, there are three shallow wells located within the Dump Site fenced area that were installed during the RI activities conducted in July 2005. As discussed during the December 18, 2008 Gibbsboro project meeting, EPA is recommending eleven new wells be installed to supplement the three existing shallow wells.

These eleven wells are comprised of 4 well couplets, 2 deep wells and 1 shallow well. The 4 well couplets are proposed at 3 off-site locations in addition to 1 location within the Dump Site. The 2 deep wells are intended to be co-located at existing shallow well locations (DMMW0001 and 0003) to form couplets. There is 1 shallow well proposed within the fenced area near the northeastern fence line adjacent to Clement Lake. These locations are presented on the attached Figure A-4.

On March 25, 2009, Ray Klimcsak (EPA) along with Patrick Austin and Arthur Fischer (both Weston) inspected the proposed locations that Weston and the drilling subcontractor (ECDI) marked out the previous week. Due to accessibility issues, there were three locations identified that would require the proposed monitor well locations to be shifted. They are as follows:

- Due to the proximity of underground and overhead utilities, it is suggested that the proposed well cluster on Marlton Avenue be shifted approximately 30 feet from the south side of the street to the north side of the street.

- Due to the proximity of a large tree, the proposed well cluster next to the Medical Arts Building (across Route 561 from the Dump Site) will need to be shifted approximately 10 to 20 feet in a northeasterly direction towards Route 561.

- Due to its location in an inaccessible area of the wetlands (soft, wet soils), it is suggested that the proposed well cluster in the middle of the site (near the base of the slope where the culvert from the Wawa parking lot runs) be shifted upslope approximately 50 feet to a more accessible, stable area.

As a result of this site walk, EPA concurred with the re-location of the well clusters located on Marlton Avenue and next to the Medical Arts Building. However, in lieu of the monitoring well cluster in the middle of the site (near the intermittent stream), EPA is requesting that three or four pore water samples be collected along the intermittent stream.

The revised monitoring well and pore water locations are presented on the attached Figure A-5.

The shallow wells will be completed within 15 feet of the ground surface and the deep wells will be screened from 25 to 35 feet bgs. It is not anticipated that the deep wells will need to be double-cased, though this option will be dependent upon the observed geology and site conditions. The present assumption is that both the shallow and deep wells will be screened in the same hydrogeologic unit at different depths.

The monitor wells will be installed using a Geoprobe® rig capable of hollow-stem auger (HSA) borings. Prior to the well installation, continuous split spoons or MacroCore® acetate sleeves will be collected and all cores will be field-screened at 2-foot intervals with a photoionization detector (PID) and x-ray fluorescence (XRF) unit. The geology will be logged by a qualified field geologist and visual observations such as staining will be noted. For each newly installed well, a soil sample will be collected from the midpoint of the screened interval or from the soils exhibiting the highest PID or XRF readings from within the proposed 10-foot screened interval, and submitted to the laboratory for TAL Metals, cyanide and total organic carbon (TOC) analysis.

In locations where a shallow and deep well couplet is to be installed, continuous logging will only be performed for the deeper boring to its target depth (25 to 35 feet bgs) and the shallow well will be installed via blind drilling to its target depth (15 feet bgs). A soil sample will be collected from both the shallow and deep well boreholes. These samples will be collected from the midpoint of the screened interval or from the soils exhibiting the highest PID or XRF readings from within the proposed 10-foot screened interval. Soil samples for laboratory analysis will be collected as described above for both the shallow and deep well boring.

In cases where only a shallow well is to be installed, then continuous logging will be performed and a soil sample will be collected from the midpoint of the screened interval or from the soils exhibiting the highest PID or XRF readings from within the proposed 10-foot screened interval, and submitted for laboratory analysis as described above.

In cases where a deep well is to be installed adjacent to an existing shallow well to form a couplet, then the deep well will be logged continuously starting at the ground surface A soil sample will be collected from the midpoint of the screened interval or from the soils exhibiting the highest PID or XRF readings from within the proposed 10-foot screened interval, and submitted for laboratory analysis as described above.

Monitoring wells will be installed by over-drilling each soil boring location using 8-inch outside diameter (4.25-inch inside diameter) hollow-stem augers. The monitoring wells will be constructed using 2-inch-diameter, schedule-40 polyvinyl chloride (PVC) well screens and riser pipes. The well screens will be 10 feet in length with 0.010-inch (10-slot) slot sizes. The well filter pack will be constructed with Morie sand #1, and granulated bentonite will be used to fill the annular seal above the sand filter pack. The filter packs will be placed in the well borehole from approximately 1.0 foot below or at the bottom of the well screens up to approximately 1.0 to 2.0 feet above the screen. A finer Morie sand #00 will be used as a choke layer between the filter pack and the bentonite seal. The wells will be finished above grade using 6-inch diameter protective steel stick-up outer casings or as flush mount installations depending upon the location. Sloping concrete pads measuring approximately 2 feet by 2 feet and 4 inches to 6 inches thick will be placed around the protective outer casings to seal and secure the wells above ground. All wells will be marked with their respective identifications on steel tags held by steel collars around the well outer casings.

Monitoring Well Development

All monitoring wells will be developed prior to the sampling event and as per NJDEP requirements, a New Jersey-licensed well driller will be used to develop the wells. All wells will be developed as per the Standard Guide for Development of Ground-Water Monitoring Wells in Granular Aquifers (ASTM, 2005).

The newly installed monitoring wells will be developed in a similar matter as the 3 existing monitoring wells installed during Summer 2005. The monitoring wells will be developed following installation by using a surge block and small submersible pumps (Whale and/or Typhoon pumps). The pump initially will be placed at the bottom of the well screen and manually surged up and down at periodic intervals. A portable turbidity meter (LaMotte Model 2020) will be used to monitor water turbidity during well development. The turbidity meter will be calibrated in the field prior to well development using turbidity standards of 1 and 1,000 nephelometric turbidity units (NTU). Water will be collected directly from the dedicated polyethylene pump discharge tubing at 5-minute intervals for turbidity monitoring, and the development water generated in the field will be purged to the ground as described below.

The monitoring wells will be developed until the development water becomes silt-free and relatively clear based on the following protocol. If turbidity levels have improved to acceptable levels after two hours, the development will be considered complete. If turbidity levels have not improved, the development will continue for up to another two hours (for a total of four hours). If, after the four hour period, an improvement in turbidity is not observed, the well will be allowed to equilibrate overnight and the development will be performed again. If no improvement in turbidity levels is observed after the second attempt, the development effort will be terminated and the well will be allowed to rest for 2 weeks prior to being sampled.

In accordance with the NJDEP Field Sampling Procedures Manual, the development water generated in the field will be discharged to the ground adjacent to the monitoring well. Discharge of the development water to the ground surface where the water is considered to be contaminated is permissible by the NJDEP August 2005 "*Field Sampling Procedures Manual*" provided the following conditions are met: 1) the water is not permitted to migrate off-site; 2) there is no potential for contaminating a previously uncontaminated aquifer; and 3) the discharge will not cause an increase to ground surface soil contamination. As provided in the June 2007 *"NJPDES Discharges to Ground Water Technical Manual for the Site Remediation Program"*, discharges to groundwater at remediation sites associated with the installation, development, and sampling of monitoring wells do not require a written pre-approval from the NJDEP or public notification.

Monitor Well Sampling Round

Two rounds of sampling will be conducted 1 month apart for all newly installed and existing wells at the Dump Site. A synoptic round of water levels will be collected at all the wells prior to the sampling event. The monitoring wells will be sampled utilizing the same procedures as described for the sampling event conducted for the 3 existing monitor wells installed during Summer 2005. The wells will be purged and sampled following the U.S. Environmental Protection Agency (EPA) low-flow groundwater sampling protocols and consistent with NJDEP protocols. In accordance with the NJDEP Field Sampling Procedures Manual, the purge water generated in the field will be discharged to the ground as described below.

While the monitoring wells are being purged, water quality indicator parameters including temperature, pH, Eh, dissolved oxygen and specific conductivity will be monitored using a multi-parameter water quality meter and flow-through cell. Readings will be collected every five minutes until stabilization has been achieved. Another parameter, turbidity, will be monitored separately during purging using a LaMotte Model 2020 turbidity meter. Depth to water will be monitored using a Solinst® electronic water level meter. A Solinst® interface probe also will be used to measure drawdown and to check for the presence of non-aqueous phase liquids (NAPLs) in groundwater. All purging parameter observations will be recorded noting the presence of discernible odors and visible sheens. A PID (MultiRAE Plus) will be used to screen for the presence of volatile organic compounds (VOCs) in the well casings prior to any well gaging or sampling.

The groundwater samples will be collected and submitted to the laboratory for CLP analyses for Target Compound List (TCL) Volatile Organic Compounds (VOCs), TCL Semivolatile Organic Compounds (SVOCs); Target Analyte List (TAL) Metals plus cyanide, TCL Polychlorinated Biphenyls (PCBs) and Pesticides as well as Total Organic Carbon (TOC), Total Dissolved Solids (TDS) and Total Suspended Solids (TSS).

In addition to investigative samples, quality assurance/quality control (QA/QC) samples will be collected in accordance with the Quality Assurance Project Plan (QAPP). Blind field duplicate and matrix spike/matrix spike duplicate (MS/MSD) samples will be collected at a rate of one per 20 samples per analytical parameter. Field blanks will be collected minimally once per event and analyzed for the same parameters as the field samples. Trip blanks (laboratory deionized water) will be analyzed for VOCs once per shipment.

In accordance with the NJDEP Field Sampling Procedures Manual, the purge water generated in the field will be discharged to the ground adjacent to the monitoring well. Discharge of the purge water to the ground surface where the water is considered to be contaminated is permissible by the NJDEP August 2005 "*Field Sampling Procedures Manual*" provided the following conditions are met: 1) the water is not permitted to migrate off-site; 2) there is no potential for contaminating a previously uncontaminated aquifer; and 3) the discharge will not cause an increase to ground surface soil contamination. As provided in the June 2007 *"NJPDES Discharges to Ground Water Technical Manual for the Site Remediation Program"*, discharges to groundwater at remediation sites associated with the installation, development, and sampling of monitoring wells do not require a written pre-approval from the NJDEP or public notification.